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THE PLANT DISEASE REPORTER

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THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

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OBSERVATIONS ON PLANT DISEASES IN ALASKA

C. L. Lefebvre

During the growing season of 1948, the four main agricultural sections of Alaska, namely the Fairbanks, Matanuska Valley, Anchorage and Homer areas, were surveyed for plant diseases[1]. Since the potato acreage was greater than that for any other crop, and as the economy of many farmers depended so much on the potato, special attention was given to this crop.

Most of the potatoes are planted in Alaska by June 1 so that diseases are not much in evidence until the latter part of June. The Fairbanks area was first surveyed and the most common disease in the early season appeared to be blackleg (Erwinia phytophthora). The severity varied from a trace in most fields to nearly 10 percent in one field. Later in the season, counts revealed that four fields had an average of around 5 percent blackleg and in one field 25 percent of the plants were infected. Traces of mild and rugose mosaic (virus) were found in every field of potatoes. In one 55-acre field about 25 percent of the plants showed mild mosaic and 50 percent rugose mosaic. At digging time this field produced around 125 bushels of potatoes per acre while the best field in the area produced approximately 330 bushels per acre. This difference in yield, however, cannot all be attributed to the heavy virus infection because this field was also comparatively badly infested with lambsquarters, one of the most troublesome weeds of the territory. Traces of spindle tuber (virus) were found in several fields, but this did not seem to be an important disease of potatoes in Alaska.

Rhizoctonia (Pellicularia filamentosa) was also found in all fields in the Fairbanks area, but in no field were over 5 percent of the plants observed to have cankers. In one late-planted field it appeared that the stems of nearly all plants were covered with the grayish, perfect stage of the fungus for three or four inches above the surface of the soil. Very little injury from Rhizoctonia was observed in this field, but if potatoes were grown on this land again the following year, as was likely, this abundant inoculum could well produce heavy infection.

The Verticillium wilt fungus[2] was isolated from plants of the variety Teton. The two-acre field from which these plants were taken was new land planted with certified seed obtained from the States. This appeared to be the only field observed that showed an appreciable number of plants with symptoms of this wilt.

According to several farmers in the Fairbanks area, ring rot (Corynebacterium sepedonicum) was first observed in 1945, and by 1947 several farmers lost at least 50 percent of their potatoes from this disease. Ring rot was the direct cause of several farmers going out of the potato growing business in 1948. Traces of ring rot-infected plants were found in only two fields in the Fairbanks area in 1948, although it was known that additional fields had been planted with ring rot-infected potatoes. The frost that occurred on August 18 killed the potato vines in most fields, making it impossible to detect ring rot-infected plants. At digging time, however, 20 percent of the tubers in one field were found to have ring rot when the gram stain technique was used. In another field, 8 percent of the tubers were infected. At the end of October two other farmers each sold a bin of potatoes containing 18 tons of tubers, but after grading 11 tons were discarded for various reasons, but one of the main causes of the loss was a high percentage of ring rot. From these examples it can be seen clearly that ring rot is an important and destructive disease of potatoes in the Fairbanks area.

Other crops appeared to be comparatively free of diseases, but scab (Streptomyces scabies) was found on radishes; leaf mold (Cladosporium) on leaves of greenhouse tomatoes; Helminthosporium avenae and Ustilago avenae on oats; Selenophoma bromigena and Helminthosporium bromi on Bromus inermis; and black stem (Ascochyta imperfecta) and Pseudopeziza medicaginis on alfalfa.

In the Matanuska Valley, ring rot of potatoes was found for the first time in 1948 in trace amounts on seven farms. In April, 1949, it was found on two additional farms in potatoes to be used for seed. Thus it seems that ring rot is getting started in this major agricultural area of Alaska, and consequently every effort should be made to prevent the spread of this important disease. Thus far, ring rot has not been serious in the Matanuska Valley, while blackleg has been the more destructive of these two diseases. In a 45-acre field where black-

[1]This survey was made at the request of and sponsored by Don L. Irwin, Director of the Alaska Agricultural Experiment Station.

[2]The writer wishes to again thank Miss Lillian Cash for isolating and identifying this fungus.

leg was unusually severe, there were several small areas of one-half acre or less where up to 50 percent of the plants were infected. Over the whole field, however, the number of infected plants was probably not over 2 percent.

Scab (Streptomyces scabies) was of concern to several farmers in the Matanuska Valley because they washed their potatoes and sacked them in 10- to 15-pound bags for sale directly to merchants in Anchorage. The deep, scaly lesions detracted from the appearance of the potatoes handled in this manner and consequently potatoes with such blemishes had to be culled.

The other diseases of potatoes were about the same as those found in the Fairbanks area, except that a trace of witches broom (virus) was found in several fields in the vicinity of Palmer.

Since many farmers have livestock in the Matanuska Valley, much more barley, oats, and wheat are grown in this Valley as compared to the amount produced in the vicinity of Fairbanks in the Tanana Valley. Consequently the smuts of oats, and covered smut of barley and wheat were found. Oat smut (Ustilago spp.) was found in all fields examined, but most farmers do not consider this serious because most of the oats are cut when green, shocked and allowed to dry in the shock, then it is brought in and used for hay. Field peas are usually sown with the oats when used for silage. The most smut was found in a 10-acre field of Trapmar barley where 26 percent of the heads were found infected with covered smut (U. hordei). In another field on this same farm, 10 percent of the heads of Chogot wheat were infected with bunt (Tilletia sp.) So far as the writer could find out, no farmer had been told about seed treatment.

Leafspots were found on many grasses and a few on legumes, but these have not been fully identified.

In the Anchorage area where seven farmers were growing about 110 acres of potatoes, ring rot was found on five of these farms during the Summer of 1948. In May of 1949, a trace of ring rot was found in stored potatoes on still another farm. This is also the first report of ring rot having been found in this area. Thus far ring rot has caused comparatively little loss in the Anchorage area as a whole because only a trace of the disease was found on the farms of two of the larger producers. One small grower, however, who produced about 600 bushels of potatoes from five acres was able to salvage only around 200 bushels because of severe ring rot infection, and this was accomplished only since he was fortunate enough to be able to market his potatoes to local restaurants within three weeks after harvest.

Ring rot on potatoes in Alaska is a serious disease and it could become more severe if precautions are not soon taken to control it. In some respects it appears remarkable that farmers have done as well as they have because they have received comparatively little help from trained personnel in the control of plant diseases. All farmers interviewed were extremely cooperative and much interested in learning to know crop diseases and how to combat them.

Blackleg was prevalent also in the Anchorage area. The most severe case was found in a one-acre increase plot where nearly 50 percent of the plants were infected.

In the Homer area, potatoes were observed on only three small farms. On two of the farms the plants were making excellent growth. However, on the third, the farmer did not believe in the use of commercial fertilizer so the plants were generally unthrifty. Moreover, blackleg and witches broom were common in this one-acre plot.

The Homer area can produce excellent vegetables and a few fine gardens were observed. The only serious injury to plants was that caused by aphids to strawberries. The leaves on most plants were purplish-red and associated with this color were numerous aphids on the undersides of the infested leaves.

The most striking disease in the Homer area was found on a cattle ranch where the farmer was cutting blue joint grass (Calamagrostis canadensis). The healthy plants were about seven feet high, while about 10 percent of the plants were considerably dwarfed by stripe smut (Ustilago striiformis).

From this brief account of diseases of crop plants in Alaska, it can be seen that many of the plants grown in the Territory have apparently many of the same diseases that occur on the same kind of plant in the States. It would appear, therefore, that research on plant diseases in Alaska should be initiated and conducted commensurate with other phases of crop research that now are underway in the Territory.

SURVEY SPONSORED BY THE ALASKA AGRICULTURAL EXPERIMENT STATION

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EXPLORATORY EXPERIMENTS ON THE USE OF ACTI-DIONE FOR THE CONTROL OF PEACH BROWN ROT AND CHERRY LEAF SPOT[1]

D. Petersen and D. Cation

Acti-dione[2] is a chloroform and water soluble antibiotic that is produced by streptomycin-yielding cultures of Streptomyces griseus. Unlike streptomycin, it possesses no marked antibacterial activity[3]. It is, however, highly active against a large number of fungi. Acti-dione has been obtained in pure crystalline form[4] and its empirical formula (cycloheximide) has been determined[5].

This article is a report of exploratory experiments on field control of peach brown rot and cherry leaf spot by Acti-dione.

Acti-dione as a Spray for Peach Brown Rot (Monilinia fructicola). Concentrations of 2, 5, and 10 ppm of Acti-dione were applied in 4 sprays as a pre-harvest fungicidal program. Applications on 12-year old Elbertas were made at 10-day intervals, beginning one month before harvest and ending the day prior to picking. Samples of firm-ripe fruit were placed in cold storage (34°F.) for 2 days and then removed to common storage for 4 additional days. Counts at the end of the 6 days storage revealed the following percentages of brown rot: 2 ppm - 2, 5 ppm - 0, 10 ppm - 1, and the control, 7. A grower program of one liquid lime sulfur spray (3 quarts in 100 gallons) and 3 sulfur dusts under like conditions resulted in 3 percent rotted fruit.

Another experiment was conducted under conditions of heavy inoculum, in a Halehaven orchard that previously had received no fungicides. An actual count showed 11 percent rotted fruit hanging on the trees two days before harvest when the experimental sprays were applied. A spray of Acti-dione (20 ppm) was compared with wettable sulfur (5 lbs. in 100). At the same time the grower sprayed the remaining trees with liquid lime sulfur (2 qts. in 100). Rot counts after 2 days in cold storage (34°F.) and 3 days in common storage revealed 84 percent rot for the Acti-dione-sprayed and 67 percent rot for the sulfur-sprayed peaches. The grower-sprayed peaches showed 89 percent rot. The count on the grower-sprayed fruit cannot be compared accurately with the count on the other two samples, as the gallonage per tree was definitely less for the grower applications.

Acti-dione showed indications of some control of brown rot in the first test but was inferior to wettable sulfur in the second test.

Although foliage injury was not noted at any of the concentrations of Acti-dione used, the 20 ppm concentration cracked firm-ripe Halehaven peaches severely. These cracks, often 1/4 inch deep, varied from one to six per fruit and radiated in many directions. Greener fruit was not so severely affected. Elberta peaches cracked less than Halehaven and the severity of the injury decreased with reduced concentrations. In addition to the cracking, Acti-dione mottled the fruit, seeming to dissolve the red coloring of the skin.

It would appear from the severe injury to near-ripe fruit that Acti-dione is of doubtful value as a peach brown rot spray.

Acti-dione Compared with Other Materials as a Peach Dip. Acti-dione, at the rate of 2, 5, 10 and 20 ppm, was used in a post-harvest fruit dip and compared with wettable sulfur and liquid lime sulfur. Two-bushel samples of Rochester peaches, placed in field boxes, were dipped for approximately 30 seconds in the various solutions. After draining for 1 1/2 hours, the samples were placed in common storage for 5 days.

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[1]Published with the approval of the Director as Journal Article 1109 of the Michigan Agricultural Experiment Station.

[2]Patented trade name of the Upjohn Company.

[3]Whiffen, A. J., N. Bohonos, and R. L. Emerson. The production of an antifungal antibiotic by Streptomyces griseus. Jour. Bact. 52: 610-611. 1946.

[4]Leach, B. E., J. H. Ford, and A. J. Whiffen. Acti-dione, an antibiotic from Streptomyces griseus. Jour. Amer. Chem. Soc. 69: 474. 1947.

[5]Leach, B. E., and J. H. Ford. Acti-dione, an antibiotic from Streptomyces griseus. Jour. Amer. Chem. Soc. 70: 1223-1225. 1948.

The following percentages of rot were counted after storage:

Material	Amount used in 100 gal.	Number of peaches counted	Percent rot
Acti-dione	2 ppm	286	95
Acti-dione	5 ppm	310	84
Acti-dione	10 ppm	279	95
Acti-dione	20 ppm	292	90
Wettable sulfur	5 lbs	292	86
Liquid lime sulfur	3 qts	286	80
Water		258	97
Non-dipped		280	94

None of the materials used in the dipping trial materially reduced rot. It was of interest to note that Acti-dione did not crack or mottle the fruit when used as a dip on Rochester variety.

Acti-dione as a Spray for Cherry Leaf Spot (Coccomyces hiemalis). Concentrations of 1, 5, and 10 ppm of Acti-dione were applied to three-year old Montmorency cherries, which were heavily infected with cherry leaf spot. The Acti-dione plots were compared with those receiving "Tennessee 26" copper (3 lbs. in 100), ferbam (1 1/2 lbs. in 100), Crag Cherry Fungicide 341B (2 1/4 lbs. in 100), and nabam (1 qt. plus 1 lb. zinc and 1/2 lb. lime in 100). The trees had received no sprays during the season. Consequently, nearly 100 percent of the leaves were infected and the trees were approximately 20 percent defoliated by August 29, the date of the spray application.

The final check on the effects of the treatments made on October 4 revealed that Acti-dione at 10 ppm had delimited all leaf spot lesions. As estimated, less than 1 percent of the lesions were active on those trees receiving 1 ppm of Acti-dione. Many active lesions were present on trees sprayed with the other fungicides, but of these copper ("Tennessee 26") appeared to have the strongest eradicative and protectant properties.

Trees sprayed with Acti-dione were markedly green when compared with those receiving the other fungicides. In addition, the Acti-dione-sprayed trees were holding a greater percentage of their leaves on October 4, when non-sprayed trees were completely defoliated.

In these trials, Acti-dione appeared to have exceptional eradicative action on the leaf spot fungus without injury to the foliage. As the spray was applied after harvest no information was obtained of the effect of Acti-dione on the fruit.

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AN ANTIBIOTIC OF POTENTIAL VALUE IN FIELD CONTROL OF CUCUMBER SCAB[1]

Donald J. deZeeuw and John R. Vaughn

Recent work on the uses of cycloheximide[2] emphasize the important possibilities of fungus plant disease control by antibiotics. Felber and Hamner[3] and Vaughn et al.[4] showed that cycloheximide was fungicidal to a number of plant disease fungi and other fungi in culture and on host tissue without being dangerously phytotoxic. This material was thus chosen for further study in conjunction with the National Cucurbit Fungicide trial in Michigan during the summer of 1949. The pathogen used in this work, Cladosporium cucumerinum, is difficult to control with fungicides at best and any material giving even partial control would be of value.

The experimental plots consisted of single rows 80 feet long randomized by treatment and replicated four times. The sprays (Table 1) were applied at approximately 7-10-day intervals on July 7, 13, 19, 29, August 16, 25, and September 1, at the rate of 75 to 125 gal. per acre depending on vine size. Inoculum, as a spore suspension, was sprayed on the foliage on July 5, 18, and August 4. By the beginning of the eighth picking (August 22) the scab epiphytotic had begun. It developed rapidly and continued severe through the remaining four pickings. Yield data were taken on total weight of fruit, cull weight, and weight of scabby fruit. From these were calculated the percentages of scabby fruit in relation to total yield and in relation to the yield of the last five pickings. All of the scabby fruit was harvested in the last five pickings and none was found in earlier pickings (Table 1).

Table 1. Cycloheximide as a cucumber scab fungicide--Michigan 1949.

Fungicide and strength used	Total lbs.	Yield of last 5 pickings lbs.	Scabby[a] lbs.	Percentage of scabby fruit: Total Percent	Percentage of scabby fruit: Last 5 pickings Percent
Cycloheximide 10 p.p.m.	187.6	90.2	24.9	13.1**	27.1**
Crag 658 2 lbs./100 gal.	212.0	100.8	31.2	14.6*	30.8*
Tribasic copper sulfate 3 lbs./100 gal.	181.0	86.4	28.6	15.8*	33.6*
Dithane Z-78 2 lbs./100 gal.	220.6	106.7	35.6	16.3	33.1*
Zerlate 2 lbs./100 gal.	198.6	92.8	39.3	19.6	41.7
Control no fungicide	201.2	87.6	38.1	19.5	42.8
L.S.D. at 5 percent level				3.7	9.1
L.S.D. at 1 percent level				5.1	12.6

*Significantly less scab than control, **Very significantly less scab.
[a]All scabby fruit in the last five pickings, earlier pickings free from visibly scabby fruit.

[1]Journal article 1107, Michigan Agr. Exp. Sta. Project supported in part by the Upjohn Company, Kalamazoo, Michigan.
[2]Cycloheximide (Acti-dione--a patented trade name of the Upjohn Company).
[3]Felber, Irma M., and C. L. Hamner. Control of mildew on bean plants by means of an antibiotic. Bot. Gaz. 110: 1948.
[4]Vaughn, John R., John L. Lockwood, G. S. Randwa, and Charles Hamner. The action of Acti-dione on plant tissue and upon certain fungi. Mich. Agr. Exp. Sta. Quart. Bull. 31: 456-464. 1949.

It was apparent, almost as soon as scab appeared, that fewer cucumbers had to be culled from rows sprayed with cycloheximide and several other fungicides than from the control rows. As the epiphytotic increased in severity with cooler weather, the total amount of culls increased in all rows, but a margin of benefit remained in the sprayed rows. This consisted of not only more non-infected cucumbers, but also somewhat smaller and fewer lesions on the infected cucumbers, from sprayed rows. The latter factor does not appear in the statistical analysis of data, since all cucumbers with scab lesions were classed alike, but it does strengthen the conclusions formed from subsequent analysis.

It will be noted in Table 1 that the fungicides are ranked in the order of their apparent efficacy in scab control. The data, expressed in percentages, are naturally subject to certain mathematical errors, but when converted to degrees by a standard method the results agreed closely with the analysis by percentage. Part of the reduction in percentage of scab might be due to decreased total yield in some rows. Cycloheximide and tribasic copper sulfate, for instance, had comparatively low total yields along with their low percentages of scabby fruit, but the control and Zerlate rows with only slightly larger total yields had disproportionately high percentages of scab. The Crag 658 and Dithane Z-78 rows with the highest total yields had relatively low percentages of scabby fruit. As a further check on the validity of scab percentages, the data on total yield was analyzed. It was found that there were no significant differences in total weight caused by either treatment or replication.

According to the data and observations in the field, Zerlate did nothing to control the development of scab even though it was one of the more promising fungicides in last year's test against other cucurbit diseases.

The authors wish to emphasize here that the data discussed are based on one year's field trial of rather small scale and may not be confirmable. It was considered of value for presentation in the Plant Disease Reporter for several reasons; 1) because it represents the use of an antibiotic in an attempt to obtain field control of a plant disease; and 2) because scab, once under way, is a difficult disease to control and any significant degree of control by fungicide, antibiotic or other, is of potential value to growers. Further work on this subject will be done next season by Michigan State College and possibly by several commercial concerns.

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EXPERIMENTS IN CONTROL OF WHITE MOLD OF BEANS BY FUNGICIDES APPLIED AS DUSTS AND SPRAYS[1]

B. F. Dana[2] and Edward K. Vaughan[3]

The economic importance of white mold caused by Sclerotinia sclerotiorum has led to an expansion of research on the control of this disease, particularly in its relation to the culture of the Blue Lake type of vining kidney beans. The joint program of investigations initiated in 1947 by the U. S. Department of Agriculture and the Oregon Agricultural Experiment Station included experiments in the control of this disease by fungicides applied as dusts or sprays. Data obtained in 1948[4] were the basis for an expanded program in this field of control of white mold during the 1949 growing season. A brief discussion is presented of the results obtained in 1949.

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[1] Published as Technical Paper No. 602 with the approval of the Director of the Oregon Agricultural Experiment Station. Joint contribution of the Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Soils & Agricultural Engineering, Agricultural Research Administration, U. S. Dept. of Agric., and the Dept. of Botany & Plant Pathology of the Oregon Agricultural Experiment Station.

[2] Plant Pathologist, U. S. Department of Agriculture.

[3] Plant Pathologist, Oregon Agricultural Experiment Station.

[4] Vaughan, Edw. K. and B. F. Dana. Experimental Application of Dusts and Sprays to Beans for Control of Sclerotinia sclerotiorum. Plant Disease Reporter 33: 12-15. 1949.

Field Conditions Favoring White Mold

Restricted aeration and over-irrigation are known to favor the development of white mold. These factors were employed to create an epiphytotic of white mold for testing the effectiveness of fungicides in the control of this disease. For restricted aeration the experimental plots were located in a low area where surrounding brush served as a windbreak, and were immediately surrounded by a wide border planted to tall-growing corn. Within this area three plots were separated by strips of corn to facilitate work with three groups of fungicides. Over-irrigation was accomplished by overhead sprinkler-irrigation applied at weekly intervals by night runs of eight to ten hours. The high level of humidity in these plots was indicated by heavy dew each night.

Close row spacing and heavy foliage growth also favor white mold. Rows were spaced four feet apart in the experimental plots. Heavy foliage growth was induced by heavy nitrogen fertilization. Under these conditions plants grew to a height of six feet or more and spread to form a row eighteen inches or more in width. Conditions of high humidity and restricted aeration in these plots were considered to be fully as favorable for development of infections as any that could be found in commercial fields.

Inoculation of the Plot Area

Steps were taken to supplement Sclerotinia occurring naturally in this area. Diseased bean plants from the 1948 plots were left on the soil and constituted heavy inoculation over part of the plot area used in 1949. Refuse containing sclerotia from cabbage and pumpkin was distributed over the area to parallel the crop history of some of the commercial areas used for beans.

Additional uniform inoculation was accomplished by sowing sclerotia from cultures along the row when bean plants were six to eight inches high. These sclerotia were grown in the laboratory and conditioned by alternate freezing and thawing for two weeks, followed by weathering under thin layers of soil. This inoculum was applied to treated rows and to adjacent border rows.

The Disease Potential in the Plot Area

Heavy inoculation and heavy irrigation at weekly intervals with restricted air circulation raised the disease potential in 1949 to a very high level. The level of actual infection in untreated and border rows was remarkably uniform throughout the experimental area. The infection potential and actual disease present were equal to or above any localized occurrence in commercial fields observed by the writers. The uniformity of severe infection potential is believed to be a basic factor in a true appraisal of the effectiveness of the fungicides used in this study.

Three Groups of Fungicides Used in 1949

The list of fungicides used in 1949 included those which showed an appreciable measure of control in the 1948 trials. Additional selections were made on the basis of value in the control of other diseases as reported by various workers. These fungicides were arranged in three groups. Fungicides in each group were applied to a separate series of plots randomized with untreated plots.

Fungicides Applied As Dusts. Kolodust and a copper-sulfur dust gave favorable results in the 1948 trials. This was also true of Zerlate and bismuth subsalicylate used as sprays. Kolodust, Zerlate, bismuth subsalicylate, and Flotox were used singly as dusts in 1949. Two combination dusts were made up as follows: one part C.O.C.S. (copper oxychloride sulfate) plus four parts Kolodust, and one part Zerlate plus nine parts sulfur.

Fungicides Applied As Sprays. Two groups of fungicides were applied as sprays. Plots sprayed with Zerlate and bismuth subsalicylate in 1948 showed low infection counts. These and Sulforon were used singly in 1949. A combination of one part Zerlate and four parts Sulforon was used in the fourth spray treatment. Triton B-1956 was used as a spreader-sticker with all sprays.

The second group of fungicides applied as sprays were materials not previously used in this project. Crag #658 (CuZnChromate L658), Fermate, Cop-O-Zink, Monsanto CP-546, and Actidione were applied singly. One part Fermate and four parts Sulforon were used together for the sixth spray in this group.

FIG. 1 DEVELOPMENT OF SCLEROTINIA IN DUSTED PLOTS

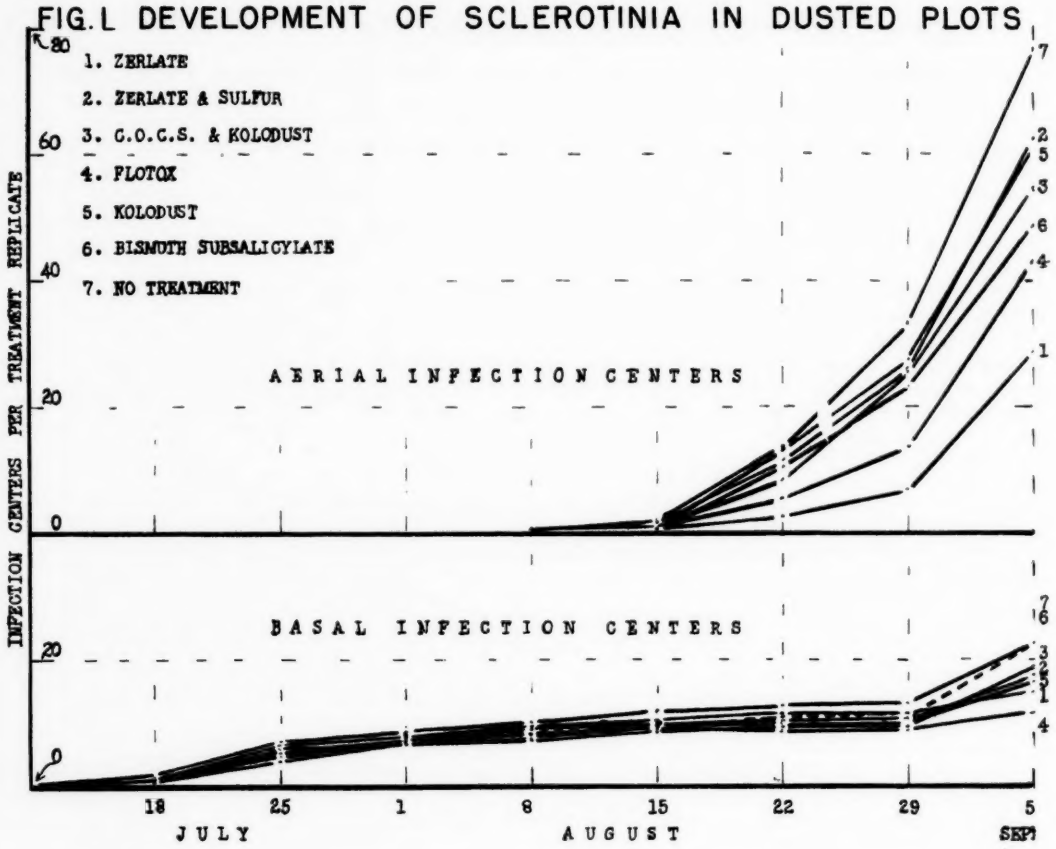

TABLE 1. FUNGICIDES APPLIED AS DUSTS

Infection Centers Per Thirty-two-foot Row: Mean of Five Replicates

Week of	1 Zerlate	2 Zerlate +Sulfur	3 C.O.C.S. +Kolodust	4 Flotox	5 Kolodust	6 Bismuth Subsali-cylate	7 No Treatment
			Aerial Infection Centers[a]				
Aug. 15	0.4	1.8	0.8	0.4	1.0	0.8	1.4
22	2.6	11.6	8.2	5.6	13.2	11.0	13.4
29	6.6	26.0	25.8	13.8	27.6	23.2	33.0
Sept. 5	28.4	62.2	54.6	43.0	61.2	48.6	76.2
			Basal Infection Centers[b]				
July 18	2.2	0.6	0.4	0.8	1.0	1.4	1.2
25	6.2	5.2	5.4	4.0	5.2	7.0	5.8
Aug. 1	7.8	7.6	6.6	7.0	7.0	8.6	8.8
8	9.6	9.4	7.4	8.4	7.2	9.8	8.8
15	10.2	9.8	8.2	8.6	9.2	11.0	9.8
22	11.4	10.4	9.6	9.0	9.6	12.8	10.8
29	11.8	10.8	9.6	9.0	9.6	13.0	11.6
Sept. 5	15.0	17.6	18.6	11.4	16.6	22.2	22.2

[a] Required for significance at .01 level Sept. 5 16.99
[b] Required for significance at .05 level Sept. 5 7.01

FIG. 2 DEVELOPMENT OF SCLEROTINIA IN SPRAYED PLOTS

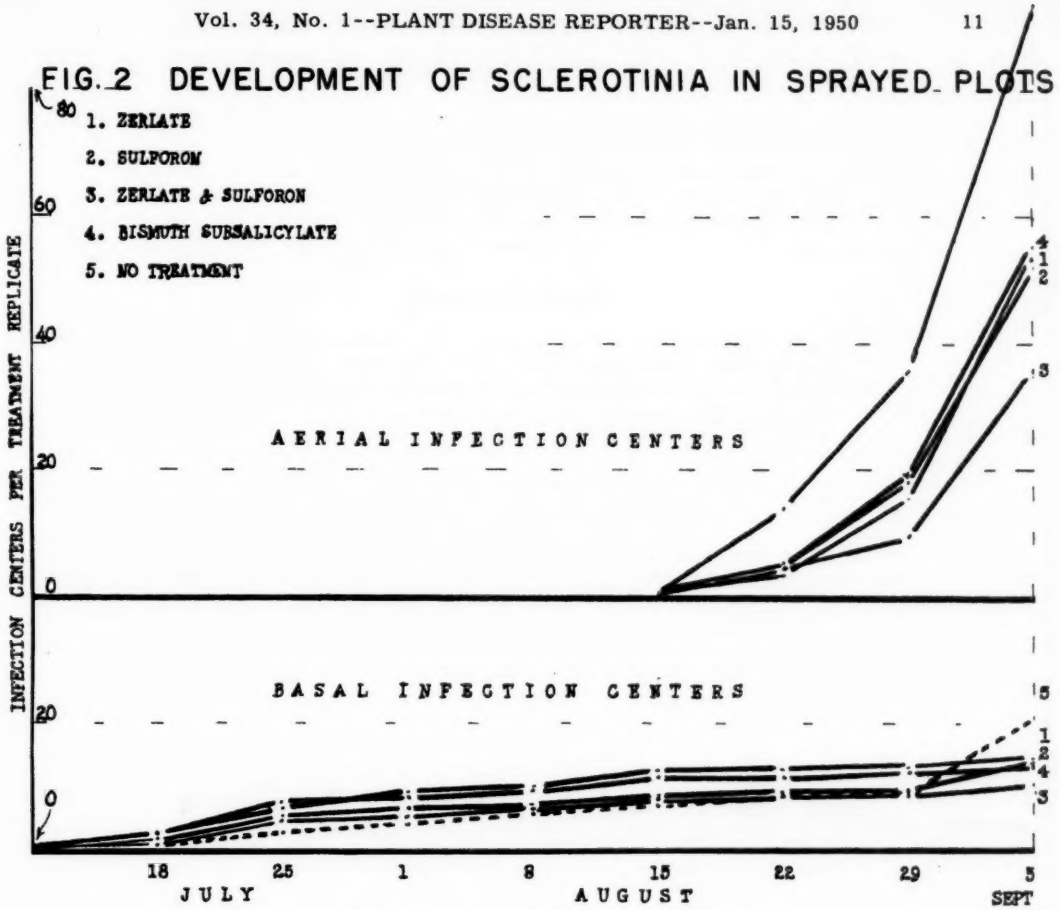

TABLE 2. FUNGICIDES APPLIED AS SPRAYS

Infection Centers Per Thirty-two-foot Row: Mean of Five Replicates

Week of	1 Zerlate	2 Sulforon	3 Zerlate +Sulforon	4 Bismuth Subsali-cylate	5 No Treatment
			Aerial Infection Centers[a]		
Aug. 15	0.0	0.0	0.0	0.0	0.2
22	3.8	5.2	4.2	5.2	14.0
29	15.4	18.0	9.6	18.4	35.6
Sept. 5	53.2	52.4	35.8	55.2	93.6
			Basal Infection Centers[b]		
July 18	2.4	2.0	0.8	2.4	0.6
25	6.8	5.4	4.2	7.2	2.6
Aug. 1	9.2	6.4	5.6	8.8	4.0
8	10.0	7.2	6.8	9.6	6.2
15	12.6	8.8	8.2	11.8	7.6
22	12.6	9.2	8.4	11.8	8.8
29	12.8	9.4	8.4	12.6	9.0
Sept. 5	14.2	14.0	10.2	13.8	21.0

[a] Required for significance at .01 level Sept. 5 37.30
[b] Required for significance at .01 level Sept. 5 6.28

FIG. 3 DEVELOPMENT OF SCLEROTINIA IN SPRAYED PLOTS

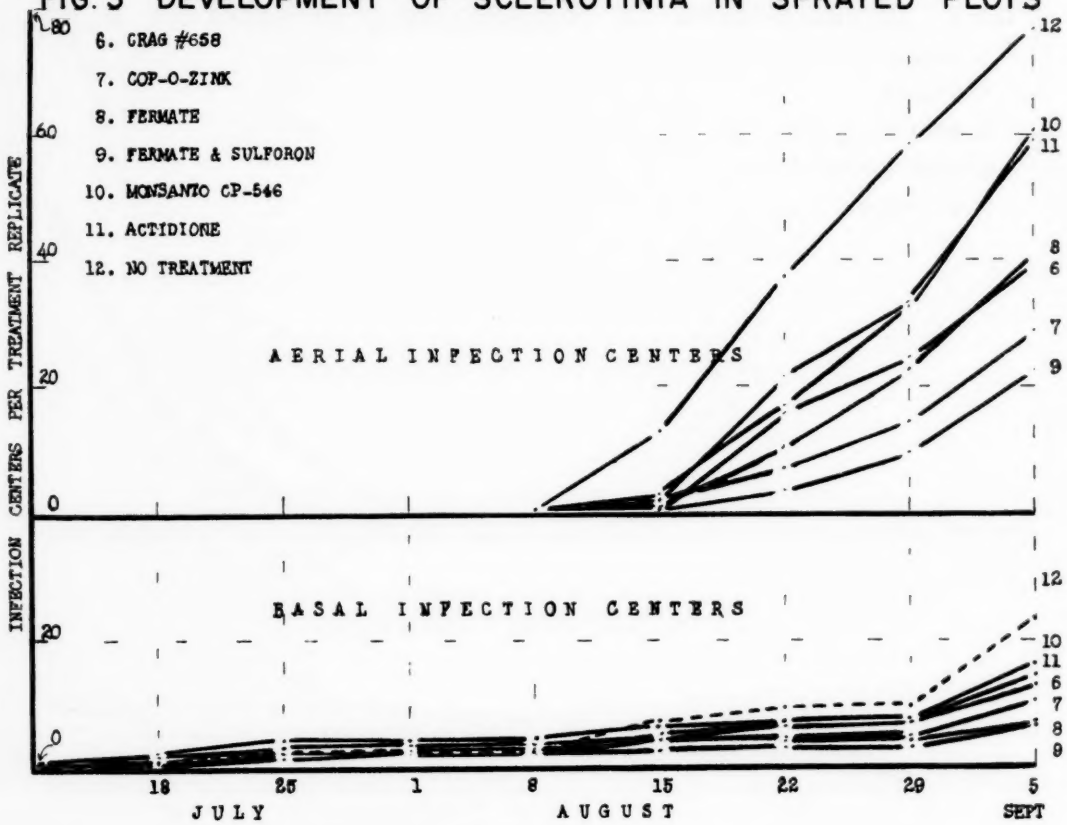

TABLE 3. FUNGICIDES APPLIED AS SPRAYS

Infection Centers Per Twenty-six-foot Row: Mean of Four Replicates

Week of	6 Crag #658	7 Cop-O-Zink	8 Fermate	9 Fermate +Sulforon	10 Monsanto CP-546	11 Actidione	12 No Treatment
			Aerial Infection Centers[a]				
Aug. 15	0.25	1.75	0.75	0.25	3.00	2.00	12.75
22	15.75	7.00	10.25	3.50	17.00	21.75	37.25
29	24.50	14.25	22.75	9.50	32.50	33.25	58.25
Sept. 5	40.00	28.75	40.25	22.75	60.25	59.75	76.50
			Basal Infection Centers[b]				
July 18	1.00	1.25	0.50	1.00	2.50	0.50	0.50
25	2.00	3.00	2.00	3.00	4.50	1.50	2.00
Aug. 1	2.25	3.25	2.00	3.75	4.50	2.25	2.50
8	2.75	3.50	2.00	3.75	4.50	2.25	2.75
15	5.00	4.00	2.50	4.00	6.25	4.25	7.50
22	6.00	4.50	3.00	4.25	7.00	6.50	9.25
29	6.25	4.75	3.00	4.25	7.50	7.00	9.50
Sept. 5	13.00	10.25	6.75	6.25	16.00	14.50	23.00

[a] Required for significance at .01 level Sept. 5 33.34
[b] Required for significance at .01 level Sept. 5 7.78

Timing of Fungicide Applications

The first application of the fungicides was made July 25 and applications were continued at weekly intervals until August 29. Although forty-eight hours intervened between irrigation and fungicide application the soil was still very wet and the plants were covered with dew in early morning at the time dusts were applied. Spray applications were made later in the same day. Both sprays and dusts were applied under conditions considered to be favorable for maximum adherence of the fungicide.

Records of Infection

Records of new infection centers were made at weekly intervals for all plots. These records were started July 18 when only basal infections were to be found. No apothecia were found at this early date and these infections are believed to have originated from contact with mycelium in the soil. On culture media mycelium develops readily from sclerotia and may also develop from these structures in or on the soil.

Aerial infections were first found the week of August 15. These were not in contact with the soil. The spore stage of the fungus appeared at the period when soil along the row became shaded by heavy growth of foliage at the base of the plants. This was also the period when the first green beans were ready for picking.

Aerial infection data are assembled in Tables 1 to 3. Averages are given of the counts of infection centers for the replicated plots for each fungicide and the no-treatment plots, for each of the three groups of fungicides. These average totals are given for each week extending from July 15 to September 5. The progressive development of the disease is portrayed in Figures 1 to 3 for the series of plots used for each treatment and also for untreated plots of each series.

Fungicides Do Not Control Basal Infections

The counts of basal infections for the week of July 18 were very low (Tables 1 to 3). The average of the counts for replicates of each treatment ranged from .4 to 2.5 infection centers per treatment. The number of centers increased slowly and for the week of August 29 had increased to averages, in the replicated plots of each treatment, ranging from 3.0 to 13.0. This range includes all the fungicides in the three groups together with the untreated plots for each group. For the plots receiving sprays 1 to 4 the counts for the week of September 5 (Figures 1 to 3) held to a low level. For the dusted plots and those receiving sprays 6 to 11 increases in infections are in a pattern similar in many cases to the pattern exhibited by counts of aerial infections in the plots receiving these sprays.

Fungicide Control of Aerial Infections

Aerial Infections Appear After Mid Season. Aerial infections appeared in treated and untreated plots as the vines became heavy enough to shade the soil and produced sufficient foliage to retain the moisture received from irrigation and dews. Only those infections not in contact with the soil were classed as aerial infections. Such infections could only have originated from ascospores. These infection centers did not appear until the week of August 15. Since plots were planted near the end of May there was an interval of some ten weeks after planting before these aerial infections appeared.

Dust Fungicides and Aerial Infection. The data from dusted plots (Table 1 and Figure 1) indicate that Zerlate and Flotox reduced infections in comparison with untreated plots. The other fungicides used were little better than no treatment through the month of August. Early in September infections in all plots increased sharply under conditions of lower temperatures and higher humidity especially in the heavily massed foliage.

It appears that all dusting could have been delayed two weeks, from July 25 to August 8, without affecting the degree of control obtained by use of the dust fungicides.

Spray Fungicides and Aerial Infections. Data for fungicides used in 1948 and 1949 are presented in Table 2 and Figure 2. These data indicate that Zerlate plus Sulforon was very much superior to the other fungicides. However all fungicides in this group greatly reduced infections in comparison with untreated plots.

Data for fungicides not previously used in these experiments are presented in Table 3 and Figure 3. They show Cop-O-Zink and a mixture of Fermate and Sulforon to be remarkably

effective in reducing the infection level in comparison with untreated plots.

DIVISION OF FRUIT AND VEGETABLE CROPS AND DISEASES, BUREAU OF PLANT INDUSTRY, SOILS & AGRICULTURAL ENGINEERING, AGRICULTURAL RESEARCH ADMINISTRATION, U. S. DEPARTMENT OF AGRICULTURE, AND THE DEPARTMENT OF BOTANY & PLANT PATHOLOGY OF THE OREGON AGRICULTURAL EXPERIMENT STATION

BEAN DISEASES IN SOUTHERN IDAHO IN 1949

Jack P. Meiners

During the summer of 1949 the following bean diseases were noted in the snap and dry bean-growing area of southern Idaho.

Dry Root Rot (Fusarium solani f. phaseoli (Burk.) Snyder & Hansen) was found to be nearly co-extensive with the crop in southern Idaho. Symptoms were found on a large majority of the plants in most fields inspected, and the disease undoubtedly causes heavy damage in the area. In a few fields in which beans were planted on land just brought under cultivation, no root rot was observed.

Sclerotinia Wilt (Sclerotinia sclerotiorum (Lib.) D By.) was present in many fields of dry beans and in one field of Idaho Refugee. It caused serious damage in fields where excessive amounts of irrigation water had been applied and the top growth of the beans was very rank. Fields in which beans had followed beans in the crop rotation were found to have more wilt present. In a field near Hazelton, Idaho, which showed heavy damage, the apothecial stage of the fungus was found to be abundant.

Pythium Wilt (Pythium butleri Subr.) was present in all fields inspected that were planted to Refugee varieties and was causing damage in a number of these. From 5 to 10 percent reduction in stand occurred in several fields of Idaho Refugee, Sensation Refugee, and Medal Refugee. The Refugee varieties seem to be more susceptible to this wilt, as it was not observed on any other varieties.

Curly Top (virus) caused light to heavy damage on susceptible varieties. The disease was especially serious in snap bean varieties planted in proximity to beet leafhopper breeding areas. Up to 50 percent reduction in stand was noted in some fields.

Red Node (virus), recently reported to be a strain of Tobacco Streak, was very widespread in southern Idaho this season, although the percentage of infection was low in most fields visited. On one farm near Shoshone, Idaho, a large percentage of the plants showed infection and the disease may have been causing some damage. The disease was found on both snap and dry varieties of beans.

Common Mosaic (virus) was present to a greater or lesser extent in most of the fields planted to susceptible varieties of beans.

Shiny Pod (Greasy Pod) (virus) was widespread in varieties of snap beans susceptible to common mosaic.

Yellow Mosaic (virus) was also very prevalent this season on all varieties of both snap and dry beans.

Other Diseases of less importance noted were Damping-off (Pythium sp.) and Sooty Mold (Heterosporium sp.). Bean rust and bacterial diseases were not found.

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, DIVISION OF FRUIT AND VEGETABLE CROPS AND DISEASES, TWIN FALLS, IDAHO

RELATION OF RAINFALL TO TIME OF DEVELOPMENT OF POTATO LATE BLIGHT IN THE FIELD AND TO THE IMPORTANCE OF TUBER ROT IN STORAGE[1]

Harold T. Cook and J. M. Lutz

Late blight (Phytophthora infestans) caused severe damage to the growing potato crop in the Red River Valley of North Dakota and Minnesota in 1948 (1, 2). According to Brentzel (1) there was more late blight on the vines than in any year on record. Since much of the potato crop in this area is stored, a storage test was made of 31 test lots from parts of 17 fields in which a survey had shown different amounts of blight at time of harvest. The object was to determine how much the tuber rot in these samples would develop and spread during the storage period.

Each sample consisted of a picker's bag of potatoes selected at random while the field was harvested. The potatoes were dumped and examined to determine the number of blighted tubers that had been picked up by the pickers. Blighted potatoes that had started to decay were discarded. In some test lots the non-rotting blight-infected potatoes were returned to the bag and stored with the healthy ones and in other lots they were discarded. Observations were made of the condition of the vines, potatoes left on the ground, and soil drainage in the vicinity of the sample bags. When possible the grower was questioned about the severity of blight on the tops, the date the disease started, the kind of fungicides applied, and when and how the vines were killed.

Most of the growers stated that blight started in August. Eide (2) reported that in the Minnesota section of the Red River Valley blight was found July 30 to August 3 in an area 25 miles wide and 75 miles long extending from south of East Grand Forks to north of Kennedy. Brentzel (1) said that in the North Dakota part of the Valley it first appeared about July 25 to 30 in Pembina County and spread to Walsh, Grand Forks, and Traill Counties.

The tops in about half of the fields had died or were killed by blight before harvest, and in the others they were killed with rotobeaters or chemicals.

Three out of the 17 fields from which samples were collected had not been sprayed or dusted with fungicides, and in each case the disease was severe and the tops completely dead. Control of blight on the vines in the 14 sprayed or dusted fields varied from practically none to good, except in two fields of the Early Ohio variety in which no apparent control was obtained even though 2 applications of copper were applied in one field and 6 in the other.

Tuber rot was worse in the low, wet areas than in the higher, better drained parts of the fields. In the low areas up to 100 percent of the tubers were affected with blight and had rotted. Only 1 percent or less of the potatoes were affected in the better drained areas.

When a field survey was made the last week in September, tuber rot could easily be found in the area about Grand Forks, but the disease had practically disappeared in Pembina County in the northern end of the Valley. The amount of blighted potatoes picked up by the pickers, the number stored with the samples, and the number found in the samples when examined on March 13 at the end of storage, are shown in Table 1.

These data show that in spite of the severe attack of blight on the foliage and the presence of many blight-affected potatoes in parts of some fields, less than 1 percent of the potatoes picked up by the laborer were affected with blight. After approximately 5-1/2 months of storage at an average temperature of 43°F. and relative humidity of 82 percent, there was still approximately the same percentage of blight-affected potatoes in the test lots as at the start. There was marked increase in blight-affected potatoes in only 3 of the 31 test lots (samples numbered 13, 21, and 28).

A study of the weather data for Grand Forks and Pembina in the central and northern portions, respectively, of the Red River Valley showed that the temperature was favorable for late blight (mostly between 60° and 74°F.) at both localities from June through September (figure 1). Rainfall at Pembina was above the 16-year average in June, July, and the first week of August, but below average during the rest of the season. The heavy rainfall during the last of July and first of August corresponds to Brentzel's (1) report of blight in that area about July 25 to 30, and the dry period following probably accounts for the absence of tuber rot when the potatoes were dug in September. The period of high rainfall lasted about 17 days longer in the Grand Forks area than at Pembina and resulted in greater damage to the potato tops by blight as well as considerable quantity of infected potatoes when dug. However, most

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[1]Report of a study made under the Research and Marketing Act of 1946, RM Project No 320.

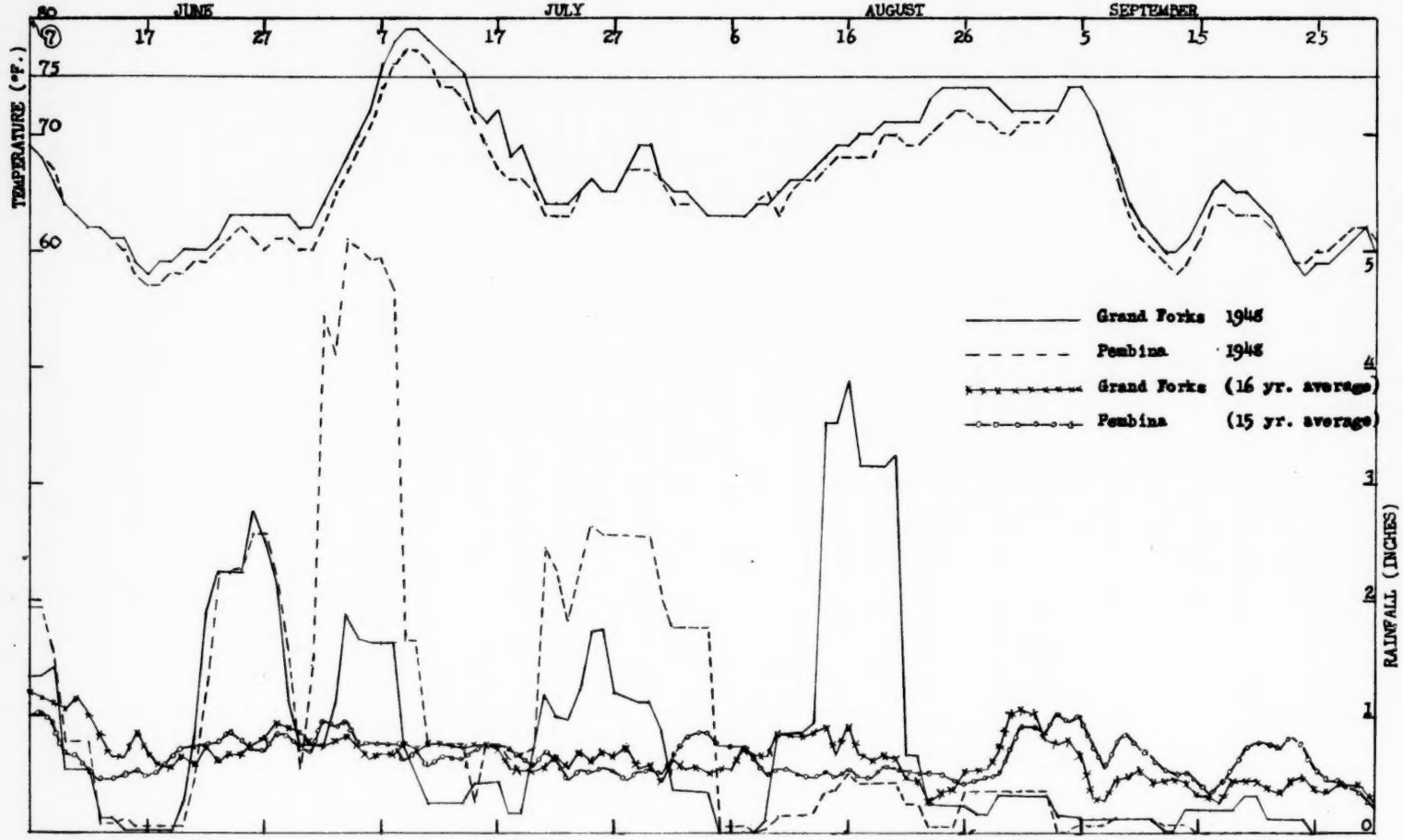

Figure 1. Rainfall and temperature in Red River Valley in 1948 and average rainfall 1933-1948. (Each point on the rainfall lines represents the total rainfall for the 7-day period ending that day, and each point on the temperature lines represents the average of the mean temperatures of the 7 days during the same period.)

Table 1. Occurrence of late blight tuber rot in Red River Valley potatoes in 1948 at the beginning and end of storage.

Variety	Sample number	Number of potatoes	Number of blighted potatoes		
			At harvest	Stored	End of storage Mar. 13, 1949
Cobbler	4	205	2	2	0
	5	251	0	0	0
	6	216	1	0	1
	7	160	0	0	0
	8	134	2	1	0
	9	191	2	2	2
	12	230	0	0	0
	16	215	2	2	2
	17	212	0	0	0
	18	196	0	0	0
	19	212	1	1	0
	20	215	0	0	0
	23	200	0	0	2
	24	213	1	1	0
Total		2850	11	9	7
Percentage			0.4	0.3	0.2
Pontiac	10	180	1	1	0
	11	149	0	0	0
	22	144	0	0	1
	26	121	0	0	0
Total		594	1	1	1
Percentage			0.2	0.2	0.2
Triumph	1	196	9	0	0
	2	211	4	4	4
	3	176	2	0	0
	13	169	1	1	5
	14	200	0	0	0
	25	129	0	0	0
	31	123	0	0	0
Total		1204	16	5	9
Percentage			1.3	0.4	0.8
Early Ohio	21	236	2	2	5
	27	180	1	0	1
	28	173	1	1	3
	29	231	2	0	1
	30	239	4	4	4
Total		1059	10	7	13
Percentage			0.9	0.7	1.2
Red Warba	15	193	0	0	0
Percentage			0	0	0
Total of all varieties		5900	38	22	30
Percentage			0.6	0.4	0.5

of the blighted tubers were decayed to such an extent that they were discarded by the pickers, and dry weather after the third week of August prevented any further infections.

These data indicate that tuber rot from late blight is unlikely to be important in storage in seasons in which blight occurs early and is followed by dry weather during the late part of the growing season and at harvest time.

Literature Cited

1. Brentzel, W. E. Late blight in North Dakota in 1948. U. S. Bur. Plant Indus., Soils, & Agr. Engin., Plant Dis. Reptr. Sup. 178: 205-206. 1948.
2. Eide, C. J. Late blight in Minnesota in 1948. U. S. Bur. Plant Indus., Soils, & Agr. Engin., Plant Dis. Reptr. Sup. 178: 200-201. 1948.

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VARIETAL DIFFERENCES IN THE DEVELOPMENT OF INTERNAL DISCOLORATION OF POTATO TUBERS IN WASHINGTON, 1948[1]

Avery E. Rich and Seth Barton Locke

Plantings of 22 potato varieties and seedlings at three locations in Washington, made in connection with disease-resistance and adaptability studies[2], offered an opportunity to obtain information on varietal tendencies to develop internal discoloration of tubers under the conditions prevailing during 1948 in Washington. About 30 tubers were selected at random from each of four replicates at each location. The potatoes grown at Prosser were placed in a commercial type unrefrigerated potato cellar at harvest time. The tubers harvested at Pullman and Mt. Vernon were stored under artificial refrigeration at about 44° F.

Table 1. Varietal differences in the development of internal discoloration of potato tubers grown at three locations in Washington in 1948.

Location	Pullman			Prosser			Mt. Vernon			Total (3 locations)		
	Number of tubers			Number of tubers			Number of tubers			Number of tubers		
Variety	Total	Phloem	Xylem	Total	Phloem	Xylem	Total	Phloem	Xylem	Total	Phloem	Xylem
Russet Burbank	120	1	4	117	3	7	127	12	1	364	16	12
White Rose	120	0	2	119	0	33	119	0	4	358	0	39
Katahdin	119	0	8	121	0	11	127	0	5	367	0	24
Warba	113	12	13	113	0	36	125	9	23	351	21	72
Red Warba	120	10	9	119	0	17	123	0	32	362	10	58
Ontario	120	0	2	120	0	14	129	12	11	369	12	27
Mesaba	120	0	3	116	1	21	126	0	10	362	1	34
Norkota	120	3	6	121	1	7	123	0	5	364	4	18
Cayuga	115	12	10	121	1	9	127	7	12	363	20	31
Menominee	121	5	3	122	0	2	125	0	9	368	5	14
Calrose	119	0	10	114	0	11	125	0	8	358	0	29
Kennebec	66	1	1	117	0	48	91	0	12	274	1	61
Essex	121	0	0	120	0	3	126	0	6	367	0	9
Chenango	120	2	1	123	0	8	123	8	18	366	10	27
Placid	120	0	1	124	0	8	124	0	8	368	0	17
Snowdrift	121	2	4	113	0	11	126	6	20	360	8	35
Cortland	120	2	3	119	0	26	124	0	1	363	2	30
Harford	120	1	8	115	0	10	126	0	2	361	1	20
Glenmeer	---	---	---	113	0	9	126	0	4	239[a]	0	(13)[a]
Ashworth	120	85	10	116	23	16	121	55	15	357	163	41
X1276-185[b]	98	0	4	122	0	11	125	0	8	345	0	23
C.S. 6316[c]	97	0	0	121	1	6	123	0	11	341	1	17
Total	2290	131	102	2606	30	324	2711	109	228	7607	275	651

[a]Represents two locations only. [b]A leaf-roll-resistant seedling from Maine. [c]A scab-resistant seedling from Colorado

In the spring, the stem end of each tuber was cut in order to determine whether any stem-end discoloration had developed. If the tuber was discolored, an attempt was made to decide

[1]Published as Scientific Paper No. 882, Agricultural Experiment Stations, Institute of Agricultural Sciences, State College of Washington.

[2]Conducted by C. L. Vincent and S. B. Locke of the Washington Agricultural Experiment Stations.

whether the discoloration was largely phloem necrosis or xylem necrosis. The results are summarized in Table 1. It will be noted that Ashworth exhibited by far the greatest amount of phloem necrosis, 163 of the 357 tubers (45.7 percent) being visibly affected. Russet Burbank (Netted Gem), Warba, Red Warba, Ontario, Cayuga, Chenango, and Snowdrift showed a much smaller number of affected tubers, ranging from 8 to 21 out of approximately 360 (2.2 to 6.0 percent). A trace of phloem necrosis was recorded for several other varieties, but it is possible that some of the discoloration may have been incorrectly diagnosed. It is assumed that most, if not all, of the phloem necrosis can be ascribed to current-season leafroll infection. At all three locations, rows of leafroll plants were grown in among the varieties being tested, to serve as a source of inoculum for them. It is possible that the high percentage of phloem injury in the Ashworth is related to its very late maturity. This would increase the chance of infection by lengthening the period of exposure to late infestations of viruliferous aphids migrating from earlier maturing varieties. It is not easy to offer an explanation for the very low phloem necrosis readings at Prosser compared with the other two locations. Prosser is located in the central part of the State where leafroll and net necrosis are most frequently a problem. It is possible that high soil temperatures shortly before, or moderately high storage temperatures immediately following, harvest may have inhibited its development. On the other hand, greater spread of leafroll has been observed occasionally at the other two locations than was observed at Prosser during the same season.

The cut tubers were planted in the spring of 1949, and leafroll readings were made during the summer. All varieties showed a sufficient percentage of leafroll to account for the amount of phloem necrosis observed. In some varieties a rather high percentage of leafroll was present where very little or no phloem discoloration had been recorded. White Rose, Mesaba, Calrose, Kennebec, Placid, and C. S. 6316 fall in this group. Katahdin, Essex, and X1276-185 showed considerable resistance to leafroll as well as a zero reading for phloem necrosis.

All varieties showed more or less xylem discoloration in some of the tubers. Fusarium oxysporum, Verticillium alboatrum, and a rapid killing of the vines by frost are probably responsible for part of this discoloration, although the actual role played by any of these factors was not determined.

A further study is being continued with the 1949 crop.

STATE COLLEGE OF WASHINGTON, PULLMAN

OCCURRENCE OF PHOMA LINGAM IN CALIFORNIA AS A SUBTERRANEAN PATHOGEN OF CERTAIN CRUCIFERS

William C. Snyder and Kenneth F. Baker

A semi-arid climate may prevent plant diseases that are limited to above-ground parts and caused by water-disseminated fungi (e.g., bean anthracnose in the West (3)). It may restrict others to a subterranean phase. Thus, the Gibberella disease of wheat exhibits only the destructive root-rot phase in California, whereas aerial infection is lacking (4). In other cases the pathogen may persist in unimportant infections at or below soil level in non-rotated irrigated crops (e.g., Ascochyta ray blight of chrysanthemum in San Mateo County (1), and Ascochyta blight of pea in the King City area, California). Other examples of this last situation have recently been observed in connection with the black leg disease of crucifers.

In 1948 and 1949 an important root rot of market-crop brussels sprouts was called to our attention by Mr. R. H. Sciaroni, Farm Advisor of San Mateo County. That occurrence of the fungus in the county (which is outside of the principal seed-producing areas) is of long standing is supported by grower observations. Infected plants showed a reddening of the lower leaves and a reduction in sprout production. In the final stage of the disease the plants wilted and tended to topple over from loss of anchorage. Decay of both roots and stems, and internal blackening, was typical of that described for the disease on brussels sprouts on Long Island by Clayton (2), except that it was confined to parts below the soil surface. No pycnidia were observed in the field, but formed rather abundantly when affected parts were incubated under moist conditions in the laboratory. Identity of the fungus with Phoma lingam (Tode) Desm. was determined by culture and pathogenicity studies. In 1949 the disease was also found in Santa Cruz County in fields of brussels sprouts grown in the coastal area south of San Mateo County.

The random distribution of diseased plants in the field indicated that the transplants were infected from refuse of a preceding infected crop either in the plant bed or in the field. Clayton has indicated that the fungus persists in land only as long as undecomposed residue of a diseased crop is present. It appeared from examination of plant beds and isolations from seedlings that the principal infection was taking place in the plant bed, which is in accord with Clayton's observation of the greater susceptibility of seedling than of mature plants. However, the absence in 1949 of leaf infections in the densely planted and continuously moist plant beds suggested that infection, which in one bed ran as high as 50 percent, probably took place from soil debris rather than from seed-borne Phoma. We observed in the spring of 1949 an instance of infection by Phoma lingam on a basal leaf of wild mustard growing among dense weeds in the brussels sprouts area of San Mateo County. We have also observed stem infections of wild radish growing in a weed strip bordering a field of brussels sprouts in Santa Cruz County in November, 1949; pycnidia were present in the lesions several inches above ground.

In all probability the original introduction of Phoma lingam occurred years ago with the sowing in the plant beds of infected seed from humid regions. Continuous cropping of the same seed beds and fields has apparently maintained the fungus on the land even though in recent years practically all of the seed used is grown locally. However, it is known that some seed produced in humid areas where the Phoma is commonly seed-borne is currently being imported into California for planting in these coastal counties.

Corroborating previous observations that black leg infection of seed crops of cabbage, cauliflower, and other crucifers is absent in California (6, 7), no infection of above-ground parts has been seen in brussels sprouts either in plants grown for market or on those left for seed production. A search made with Mr. Sciaroni in six different locations in San Mateo County during the 1949 season for infection in plants permitted to go to seed, revealed the fungus to be absent in aerial parts.

Apparently the fungus was first found in the State in Santa Barbara County in May, 1945 in plants that were dying prematurely in a trial-ground planting of sweet alyssum (Lobularia maritima Desc.). No pycnidia were found on the plants, but isolations made from below-ground parts yielded P. lingam. Cauliflower seedlings, the roots of which had been dipped in a spore suspension of one of the cultures, developed typical black leg symptoms in the greenhouse where moist conditions also permitted development of pycnidia on the stems and basal petioles. This culture was used by Pound (5) in comparative studies with other isolates.

The fungus was again isolated in June, 1946 from below-ground parts of dying plants of Iberis umbellata L. in the same trial ground in which crucifers had been repeatedly cropped.

Summary and Conclusions

Black leg of crucifers, caused by Phoma lingam, has been found as a subterranean disease of some cultivated cruciferous crops in the growing areas of San Mateo, Santa Cruz, and Santa Barbara Counties. Observations indicate that, once Phoma lingam is introduced into a field with seed or infected transplants, the fungus may persist there indefinitely, even under semi-arid conditions, when crop rotation is not practised. Because aerial infections of cultivated crops have not been found, survival of the fungus appears to depend on invasion of subterranean parts of crucifers that are continuously cropped on the land. The importation of seed from humid regions may supplement and replenish the inoculum carried over from season to season in infected refuse. Economic loss from below-ground infection generally seems to have resulted in California when seed is sown on infested soil, perhaps because of the greater susceptibility of seedlings than of adult plants. Some invasion of older plants may also permit perpetuation of the fungus in the field, but with less economic damage.

The seed produced by diseased cultivated crucifers in California is uninfected because of the absence of the aerial phase of black leg.

Literature Cited

1. Baker, K. F., A. W. Dimock, and L. H. Davis. Life history and control of the Ascochyta ray blight of chrysanthemum. Phytopath. 39: 789-805. 1949.
2. Clayton, E. E. Black-leg disease of brussels sprouts, cabbage, and cauliflower. New York (Geneva) Agric. Exp. Sta. Bul. 550. 27 pp. 1927.
3. Mackie, W. W., W. C. Snyder, and F. L. Smith. Production in California of snap-bean seed free from blight and anthracnose. California Agric. Exp. Sta. Bul. 689. 23 pp. 1945.
4. Oswald, J. W. Fungi causing root rots of cereals in California. (Abstract) Phytopath. 37: 845. 1947.
5. Pound, G. S. Variability in Phoma lingam. Jour. Agr. Research 75: 113-133. 1947.
6. Snyder, W. C., and K. F. Baker. Diseases of Seed cabbage in California. Plant Dis. Reptr. 27: 394-398. 1943.
7. _____, and _____. Diseases of seed cauliflower in California. Plant Dis. Reptr. 29: 248-253. 1945.

DIVISION OF PLANT PATHOLOGY, UNIVERSITY OF CALIFORNIA, BERKELEY AND LOS ANGELES

OCCURRENCE OF BLACK SHANK AND OTHER DISEASES ON BURLEY TOBACCO IN EAST TENNESSEE, IN 1949

H. E. Heggestad and E. E. Clayton

Black shank (Phytophthora parasitica var. nicotianae) was found in Eastern Tennessee for the first time this year. The outbreak was confined to Greene County. An intensive survey, conducted in the county by the cooperation of several agricultural agencies, showed infection on about 35 farms.

Greatest loss from the disease occurred on a farm about five miles north of Greeneville. The farmer harvested only about 2 percent of the plants from 2 1/2 acres. Examination of the stubble of harvested plants one week after harvest showed black shank present even on these plants. In 1948, the same field produced more than one ton per acre of leaf averaging 55 cents per pound.

The 1949 outbreak of black shank in East Tennessee became conspicuous following a protracted wet period. A total of 3.89 inches of rain fell during nine days, with some rain every day. During this period, the relative humidity averaged 88 percent and the mean temperature was 78 degrees. In addition to the usual root and stalk decay there were many large, brown necrotic leaf lesions, two to four inches in diameter. Relatively few plants were invaded by way of the roots. Most infection occurred through nodes at the ground level.

Immediately following the rainy period there was much wilting due to water-logged soil. This was at first confused with the black shank. However, most plants that wilted from water-logging recovered in a few days. In contrast, black shank plants did not recover from the wilting and the leaves developed a very characteristic golden appearance that was conspicuous in the fields before the tobacco was topped (Figure 1). Most of the black shank appeared in low parts of fields, the spread being evidently associated with drainage water. In the instances where the disease appeared on high land it was evident that infested soil had been carried by machinery or in other ways.

Four different growers with heavy losses believed they had a few diseased plants in their

Figure 1: The wilted, light (golden) colored diseased plants are most conspicuous among the dark (green) healthy plants in burley fields, especially before topping.

fields the previous year. In any case, greatest losses occurred in fields which had been in tobacco the previous year.

Control of black shank by rotation will be especially difficult in East Tennessee, with its rolling to mountainous topography. Most of the farms are small, with only a few acres of tillable soil that may be used for profitable tobacco production. Frequently, flash floods occur, causing streams to overflow onto bottom fields. Sheet erosion frequently brings water laden with silt and filth across the upland fields. The developments of the year, plus experience in other areas, strongly suggests that the spread of the disease will be rapid in East Tennessee.

A cooperative State and Federal program for developing new varieties resistant to black shank is being undertaken at the Tobacco Station near Greeneville.

Wildfire (Pseudomonas tabaci) was unusually prevalent and destructive in plant beds this

year. The disease was present in most fields, but the damage was relatively mild, especially on early harvested crops. Late in August moisture conditions were again favorable for disease development and appreciable losses occurred to crops harvested after September 1.

Blue mold (Peronospora tabacina) was first reported on April 26 in Coffee County, Middle Tennessee, and was very destructive in that county. The disease did not appear in Upper East Tennessee until May 6, and although widely distributed, it was one of the mildest attacks in recent years.

Root knot (Heterodera marioni) was more prevalent this year than in the past several years. The disease was so severe in two plant beds that the farmers abandoned the beds and secured plants elsewhere. Both bed sites had been used the previous year and yielded satisfactory plants. Stunted plants with severely clubbed roots were observed in a number of fields. Total damage was not large.

As in 1948, damage caused by frogeye (Cercospora nicotianae) was most prevalent on burley crops throughout Tennessee. The disease was present on even the top leaves by August 20. Crops which were harvested early, showed "green spots" in the cured leaf. This results from immature lesions at the time of harvest. The late tobacco crops were reduced in both yield and quality because of the disease. Frogeye was definitely the most destructive leaf spot disease in 1949.

Brown spot (Alternaria longipes) which was so ubiquitous in 1948 was absent or very inconspicuous in fields this year.

DIVISION OF TOBACCO, MEDICINAL AND SPECIAL CROPS, BUREAU OF PLANT INDUSTRY, SOILS AND AGRICULTURAL ENGINEERING, AND TENNESSEE AGRICULTURAL EXPERIMENT STATION

SMALL GRAIN DISEASES IN KENTUCKY IN 1949

L. M. Josephson and D. A. Reid

Observations on diseases in small grains this year covered the principal grain growing areas in central and western Kentucky. Detailed notes were recorded on the Experiment Station farm at Lexington and at outlying test fields in Todd County in southwestern Kentucky, and in Daviess County, in the lower Ohio River bottoms. A number of commercial fields were examined, particularly during the two months preceding harvest.

In general, many of the common diseases were not so heavy as in the preceding year but several of the generally more minor diseases caused damage in localized areas. Central Kentucky was relatively dry during the spring months, while in some areas in the western part of the State excessive rainfall delayed field work at times and promoted incidence of certain diseases.

BARLEY

In contrast with the past two years, powdery mildew (Erysiphe graminis f. sp. hordei) was so light at Lexington, both in the fall and spring, that differential notes were impossible. Light spring infections were noted in several fields on lower leaves, but in only two cases were infections heavy enough to cause any damage.

Leaf rust (Puccinia anomala) (P. hordei) was present in nearly all fields observed, and was quite heavy in plots in Todd County by mid-May.

Field inspection and reports from several county agents indicated that loose smut was serious again this year. One field inspected had an estimated 20 percent smutted heads, and several had 3 to 5 percent loss. Spores from several locations when germinated showed all collections to be Ustilago nuda. Covered smut (Ustilago hordei) was present in nearly every field observed, but the maximum in any one field was 3 percent.

"Scald" (Rhyncosporium secalis) was prevalent over most of the state but most severe in southwestern Kentucky. Nebraska Sel. 412487 at the nursery in Todd County was practically defoliated before the barley was mature. The disease had extended down on the leaf sheaths after the leaves were killed. The yield of this strain was 15.2 bushels per acre, compared with an average of 31.3 bushels for the 26 varieties in the nursery; and it is believed that this disease accounted for considerable of the reduction in yield. The disease was also severe on Wong in a commercial field near Bowling Green but not quite so heavy on this variety in Todd County.

Scald was light on Kentucky 1 near Shelbyville. On susceptible varieties, such as Wong, the disease was characterized by large oval, water-soaked lesions with distinctly darker margins. Often the lesions coalesced and the entire leaf was killed. On Kentucky 1 the disease was characterized by oblong, narrow, dark lesions.

Net blotch (Helminthosporium teres) (Pyrenophora teres), and spot blotch (H. sativum) were present in only small amounts and not nearly so severe as in 1948.

Several non-parasitic leaf markings occurred on selections in the nursery at Lexington. One selection was characterized by lesions made up of concentric rings. The rings were dark in color with light areas appearing between the rings. The lesions were oval in shape and at the tips of the leaves extended across the width of the leaf. The general appearance of the lesions was suggestive of a fingerprint.

WHEAT

Leaf rust (Puccinia rubigo-vera var. tritici) was rather heavy in the western part of the State before ripening. However, it was very scarce in the Lexington area, and for the first time in several years it was not possible to take differential notes. In contrast to 1948, stem rust (Puccinia graminis var. tritici) was almost completely absent this year.

Septoria leaf spot (Septoria tritici) was present in all varieties in both plots and nursery in Todd County. Purcam and Redhart were the most heavily infected. In one commercial field of Thorne, in Nelson County, practically all of the lower leaves were killed by Septoria by the time the crop was in the soft dough stage. The leaves remaining at the time the field was visited at the end of May were heavily infected with Septoria. Considering the stage of the wheat, considerable damage was probably due to leaf killing. In a field of Currells in Warren County, Septoria had destroyed about one-third of the leaves by the middle of May. It is interesting to note that neither Thorne nor Currells was very heavily infected in the plots in Todd County, compared to Redhart and Purcam.

Loose smut (Ustilago tritici) was found in most fields but was not heavy except in the variety Goens. Other varieties had a maximum of 3 to 4 percent smutted heads; most of them had only a trace.

No mildew was found on wheat this year.

On June 9 a small increase field of Purcam at Allensville showed 5 percent of the heads that were blackened and appeared to be dead. These heads stood out clearly from the healthy heads. The diseased heads seemed to be concentrated in definite areas in the field and appeared to spread from infection centers. The heads at first appeared to be infected with Septoria glume blotch, but examination showed them to be covered with a sooty mold. The mycelium formed a velvety, blackish-olive patch on the kernels. The conidia were pale, 1-3 septate and 10-15μ x 4-7μ in size, which answers the description for Cladosporium herbarum, the conidial stage of Mycosphaerella tulasnei. This fungus has been reported to cause a serious disease in Europe, being especially injurious to cereals after a rainy season preceded by a drought, which are the conditions that existed in this field. This disease has been reported to be present on apples and certain vegetables in New York, New Jersey, West Virginia, Ohio, Michigan, and the West Coast. No attempt has as yet been made to reinfect wheat, but it is suspected that the Cladosporium was present on the wheat heads as a saprophyte only. However, the culms and roots were healthy and there was no evidence of trouble which might account for preliminary injury. In certain respects the heads were typical of those being overrun with saprophytes following preliminary killing of the plants. In this particular case there was no evidence of premature killing and the kernels were only slightly shriveled. Similar symptoms were also found on Purcam at Lexington as well as on other varieties (Vigo) and selections. In later stages some plants of Purcam became covered with spores of saprophytic fungi, especially around the nodes.

On June 7 a field of wheat (mixture of varieties) in Scott County, just north of Lexington, was inspected in company with Dr. W. D. Valleau, which had 25 to 50 percent of the plants prematurely killed. The killing occurred in patches in the field but was not limited to any definite area and did not appear to be nutritional. Soil analysis showed phosphorus and potash to be sufficient. Most of the wheat had headed by the time the killing occurred, but the dead plants were shorter than the surrounding healthy plants. Healthy plants occurred along with dead plants in individual clumps, and in some cases an individual culm of a plant was healthy while the remaining culms of the plant were killed. The killing was not restricted to any one variety in the mixture. Examination of the plants showed the crowns to be rotted and the lower leaf sheaths and crowns to be covered with dark mycelial masses. No spores could be found. Plating produced Alternaria, Fusaria, and bacteria. (The bacteria probably were secondary, after the crowns rotted.) Symptoms would indicate a fungus to be responsible for the killing but no fruiting bodies could be

found and no fungus was established as being the cause for the killing. The writers are not familiar with the symptoms of the Western wheat mosaic but there is a possibility that the trouble may have been of a virus nature.

OATS

Crown rust (Puccinia coronata) was present in all fields observed but appeared to be rather late compared to the maturity of the crop, and did not reach maximum infection on susceptible varieties. It is doubtful whether damage was as heavy as in 1948, when infection was very heavy in the western part of the State. Little crown rust occurred on fall-sown oats at Lexington, and infection was late on spring oats. One commercial field of Clinton, in Nelson County, had from 80 to 90 percent of the leaves infected, but the severity was light. Little stem rust was found.

Helminthosporium victoriae was again very light on spring oats and has not yet been found on susceptible fall-sown varieties in Kentucky.

Anthracnose (Colletotrichum graminicolum) was very severe in the fall-sown nursery in Todd County on the varieties Sturdy and Anderson 1. On May 30 practically all the leaves on Sturdy were killed when the oats were still green. The disease was not quite so severe on Anderson 1. No visible effect of the disease was noted on any other variety in the nursery, although it may have been present in small amounts. A small amount of anthracnose was found in an oat field near Bardstown but was not detected in any other location. This is the first reported occurrence of anthracnose on oats in Kentucky.

A condition which was particularly evident on fall-sown oats at Lexington this year was "red leaf." Considerable varietal difference was evident in reaction to this condition. By mid-April, lower leaves showed a heavy reddish-purple color, particularly on the lower leaves. Soil and tissue analyses showed sufficient phosphorus and potash. An application of nitrogen in late spring enabled the plants to grow away from the condition faster than those not treated, but affected leaves did not recover. Apparently the condition was rather general in the State, from reports received. No lesions were found in the early stages, but saprophytic fungi appeared after the lower leaves had died. With warmer weather in late spring the oats seemed to grow out of this condition, and upper leaves were little affected.

RYE

"Scald" (Rhyncosporium secalis) was prevalent on the Balbo variety at the Todd County test field, with four to five lesions per leaf, but it probably did not reduce the yield a great deal.

Anthracnose (Colletotrichum gramincolum) caused 30 percent breakage in Balbo in this same plot. Mycelia and pycnidia were prevalent at the base of the plants above the crown, but were prevalent only in the broken culms.

KENTUCKY AGRICULTURAL EXPERIMENT STATION, LEXINGTON

NEW HOSTS OF VERTICILLIUM ALBO-ATRUM

William C. Snyder, H. N. Hansen, and Stephen Wilhelm

During the past few years Verticillium albo-atrum Rke. & Bert. has been isolated by the writers from vascular tissues of the following plants in California showing symptoms of hadromycosis: cabbage (Brassica oleracea var. capitata L.), brussels sprouts (B. oleracea var. gemmifera Zenk.), icicle radish (Raphanus sativus L.), Crandall blackberry (Rubus alleghaniensis Porter), pistachio[1] (Pistacia vera L.), heather[2] (Erica australis Hort. and E. persoluta L.), olive (Olea europa L.), Transvaal daisy (Gerbera jamesoni Bolus), nightshade weed (Solanum nigrum L.), and ripe fruit of the tomato (Lycopersicon esculentum Mill.). In addition Verticillium was isolated from garden stock (Mathiola incana R. Br.) showing typical symptoms

[1]Isolations from pistachio made by Dr. W. B. Hewitt, University of California, College of Agriculture, Davis, California.

[2]First recognized as a serious disease and brought to our attention by R. H. Sciaroni, Farm Advisor, San Mateo County.

of Verticillium wilt without the rotting of the roots and lower stem described earlier by Smith (4).

This appears to be the first report of Verticillium wilt for cabbage, brussels sprouts, radish, heather, transvaal daisy and pistachio; the first report in the United States for olive and the nightshade weed, and the first report in California for the Crandall blackberry. Verticillium wilt is known in Europe on olive (3) and nightshade (5). In England stock has been reported susceptible upon inoculation (6) whereas in New York it has been reported as immune (2). These differences suggest strain variations in the fungus.

Verticillium wilt caused extensive losses in fields of brussels sprouts in Monterey and San Mateo Counties in 1949. Affected plants were stunted and showed pronounced interveinal yellowing particularly of the lower leaves. A black vascular discoloration extended often to the top of the plant.

Young olive orchards in Tulare, Madera, and Solano Counties, particularly those planted on land previously cropped to tomato, are often severely injured by Verticillium wilt. Affected trees show a characteristic dying back of limbs and leaf casting, often without conspicuous vascular discoloration.

In San Mateo County commercial plantings of heather have suffered heavy losses from Verticillium wilt. Affected plants were stunted, showed die-back of branches and extensive dropping of leaves. They often eventually were killed. As was found previously with Fuschia (1), affected heather did not exhibit a distinct vascular discoloration.

The nightshade weed was found commonly infected with Verticillium in Santa Cruz County in irrigated truck crop and orchard land. In certain areas as high as 95 percent of the nightshade selected at random has yielded V. albo-atrum in culture. Infected nightshade plants commonly are symptomless apart from a rather faint reddish-brown discoloration of the xylem.

Inoculation experiments have shown marked strain differences among isolates of Verticillium obtained from the plants mentioned above. Isolates from cabbage and radish are cross-infective and produce the disease upon inoculation. Isolates from brussels sprouts, cabbage, stock, radish, and nightshade so far have been found non-pathogenic for Bonny Best tomato in greenhouse inoculation tests in which washed roots were dipped in a spore suspension. Isolates from olive and Crandall blackberry cause severe wilt in tomato. This corroborates the evidence already on hand of the existence of strains of V. albo-atrum differing in pathogenicity.

Literature Cited

1. Baker, K. F., W. C. Snyder, and H. N. Hansen. Some hosts of Verticillium in California. Plant Dis. Reptr. 24: 424-425. 1940.
2. Dimock, A. W. Importance of Verticillium as a pathogen of ornamental plants. Phytopath. 30: 1054-1055. 1940.
3. Ruggieri, G. Nuova malattia dell'olivo. Ital. Agric. 1946, 7, 6 pp. In Rev. Appl. Mycol. 27: 286. 1947.
4. Smith, Ralph E. Diseases of flowers and other ornamentals. California Agr. Ext. Circ. 118. 108 pp. 1940.
5. Van der Meer, J. H. H. Verticillium wilt of herbaceous and woody plants. Med. Landbouwhoogeschool te Wageningen 28: 1-82. 1925.
6. Williams, P. H., Enid Oyler, H. L. White, G. C. Ainsworth, and W. H. Read. Plant diseases. Cheshunt Exp. Res. Sta. Rept. 1938: 39-63. 1939.

DIVISION OF PLANT PATHOLOGY, UNIVERSITY OF CALIFORNIA, BERKELEY

A COURT NOUÉ-LIKE DISEASE FOUND IN CALIFORNIA GRAPE VINES

Wm. B. Hewitt and A. J. Winkler

Some severely dwarfed grape vines with malformed leaves were first called to our attention in the spring of 1948. These were five-year old vines of the variety Pinot Chardonnay (Vitis vinifera) on St. George (Rupestris St. George) root stock. New growth on about 4 percent of the vines in the vineyard was dwarfed and many of the shoots were abnormally branched. The shoot nodes were close together and some of them had one or two extra buds. Leaves on these vines were much smaller than normal with various degrees of malformation. The petiolar sinuses of the leaves, which are normally narrow in Pinot Chardonnay, were spread out and the margins

straightened; in some instances the angle was over 200 degrees. The five main veins of these leaves were gathered toward the midrib.

Clusters in most cases failed to set much fruit. They were straggly and contained many shot berries.

By midsummer the diseased vines were growing fairly vigorously. The new growth became more nearly normal as the season advanced, and by September it was difficult, except by careful examination of the older foliage, to distinguish diseased from healthy vines.

This young vineyard located in Santa Clara County, California, was propagated by budding, and the wood came from vines over 65 years old which have since been removed. The exact source of the original Pinot Chardonnay stock has not been determined; however, the evidence indicated that it was imported from France.

Root stocks were propagated from old St. George vines scattered through various vineyards. These vines developed from root stocks previously grafted to varieties that had failed or been destroyed in some way. It was not possible to trace the source of all of the St. George propagating stock used for the planting.

During the 1949 season the same Pinot Chardonnay vines developed symptoms similar to those which had shown the previous growing season, but they were not as severe. A very similar disease was observed in some young Cabernet vines in an adjoining vineyard. The disease was also observed on some six-year old Cabernet vines in a vineyard in Napa Valley.

Since the early spring of 1948, a disease which has developed in a manner very similar to that of the Pinot Chardonnay and Cabernet has been observed on French Colombard vines in the Napa Valley.

All three varieties showed the early season dwarfing, node deformity, shoot branching, leaf abnormalities, flower shelling, and apparent recovery during mid and late season. The symptoms resemble very nearly those of the European vine disease Court noué or infectious degeneration.

Even though tests designed to determine the possible cause of the disease have not been completed, it seems desirable because of the importance of the disease in European vineyards to record the apparent presence of this disease in California.

UNIVERSITY OF CALIFORNIA, COLLEGE OF AGRICULTURE, DAVIS, CALIFORNIA

OBSERVATIONS ON THE OVER-WINTERING OF THE PATHOGEN CAUSING DOWNY MILDEW OF SPINACH IN THE WALLA-WALLA AREA

Charles M. Wright and William D. Yerkes, Jr.

In the State of Washington a considerable acreage of spinach is grown for processing and for the fresh market in the Walla-Walla area. In past years growers have occasionally suffered serious losses due to downy mildew, caused by Peronospora farinosa (Fries) Fries. The disease has become so severe in the past three years that the growers now consider it unprofitable to make two plantings a year but rely on a single fall crop. Experimental work is now being conducted in an attempt to control this disease under local conditions. In connection with this work an observation has been made regarding the possible method of over-wintering of the pathogen. Because it appears to differ from the commonly accepted belief that over-wintering is by means of mycelia in over-wintered spinach plants, at least in the northern States, brief mention of this observation is herein reported.

In the spring of 1949 no fields of spinach were planted in the Walla-Walla area. A survey indicated that, with the exception of one small planting, all volunteer spinach was winter-killed. In the 1949 fall plantings the first downy mildew was found in two fields at the west end of the area. From previous experience the growers accurately predicted the exact locations in these fields at which the downy mildew would appear. In both of the fields the initial infection was confined to an area of about 50 feet in diameter. Secondary infection spread to the rest of the spinach plants of the area, as weather permitted. These two fields had been planted to spinach for several years previously, but had an intervening lettuce or onion crop in the spring of 1949. This observation would indicate that oospores, either in the soil or planted with the seed, serve as a source of primary inoculum in this area, and that some unknown soil factor may regulate the viability and germination of these spores. Experimental work is being conducted to determine this point.

WASHINGTON INSTITUTE OF AGRICULTURAL SCIENCES

DOWNY MILDEW ON BARLEY IN MISSOURI

C. H. Kingsolver

Downy mildew (Sclerospora macrospora Sacc.) was found attacking barley plants on the Southeastern Experimental Farm of the Missouri Agricultural Experiment Station at Sikeston, Missouri in June, 1949. Scattered plants in a low wet area were found to be infected. These plants were found in an increase plot of a selection from a Kentucky 5 x Missouri Early Beardless cross (B400). Barley plots on other areas of the farm were examined but infected plants were not found.

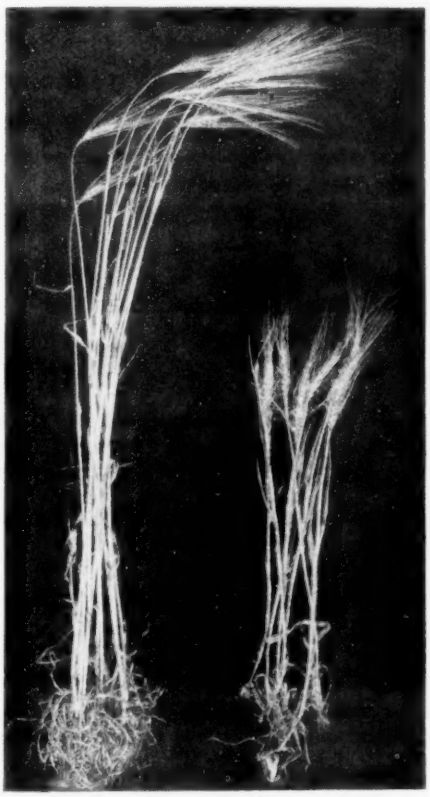


Fig. 1. Left, healthy plants of barley. Right, plants infected by Sclerospora macrospora Sacc.

Infected plants were stunted and malformed as illustrated in Figures 1 and 2. Various amounts of stunting, malformation and distortion were observed, ranging from plants which exhibited slight thickening of one or more upper leaves to severely stunted plants with thickened leaves, leaf sheaths, and culms. In addition to twisting and distortion a rugose appearance caused by hypertrophy of tissue between veins was characteristic of severely infected plant parts. All parts of heads of severely infected plants were affected. Shortening, thickening and distortion of the rachis, thickening and malformation of the florets, and in particular, thickening and twisting of the awns were characteristic. No developed seed was found in severely infected heads and it was apparent in most cases that development of the embryo had begun but failed to continue.

Oogonia and oospores of the fungus were found in all parts of the plants which showed symptoms. The size and morphology of the reproductive organs were very similar to published descriptions of Sclerospora macrospora. Immature oospores in foliar tissue and culms exhibited poorly developed wall structure and fusion of the oospore and oogonial wall was not evident in all cases. No shredding of foliar tissue was evident and oogonia and oospores were firmly imbedded in host tissue.

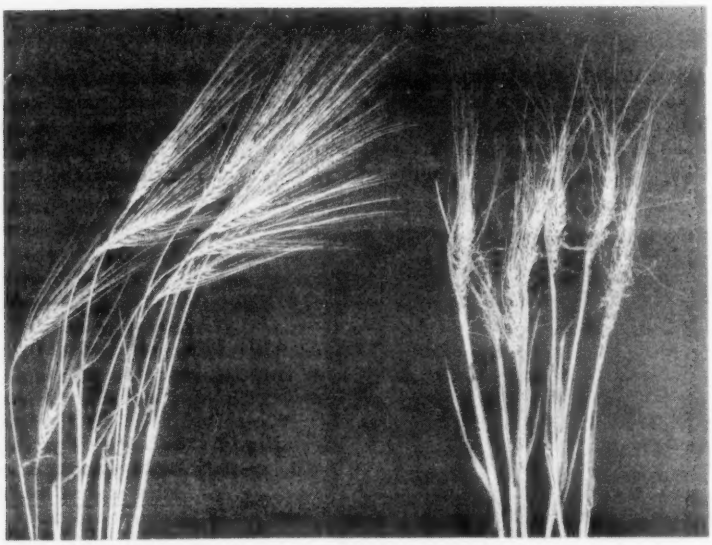


Fig. 2. Left, Healthy heads of barley. Right, heads infected by Sclerospora macrospora Sacc.

According to the Check List Revision by Freeman Weiss, a report from California is the only record of the occurrence of Sclerospora macrospora on barley in the United States (PDR, 29 (9): 226. Mar. 15, 1945). This is believed to be the first report of the fungus on barley from Missouri and the Middle West.

BOTANY DEPARTMENT, MISSOURI AGRICULTURAL EXPERIMENT STATION, COLUMBIA
Journal Series No. 1191.

WORLD REPORTING ON PLANT DISEASES, INSECT PESTS AND CONTROL INFORMATION

(Dr. Karl Olsen has given permission to quote the following recommendation from the report of the Conference of the Food and Agriculture Organization of the United Nations, Fifth Session, Nov. 21, 1949, Annex V to report of Commission II: Report of the Agriculture Panel to Commission II).

The Conference recognizes that plant diseases and insect pests readily cross national boundaries, becoming established in new territories and often causing serious and widespread damage; and that a world reporting service, which might be progressively built up from relatively modest beginnings, would be of immense value in providing for governments information that would make possible adequate control and preventive measures.

Therefore THE CONFERENCE --

RECOMMENDS that

(1) FAO should aim at establishing or bringing about the establishment of such a centralized service to report on the incidence of plant diseases and insect pests of such economic importance as to require coordinated action by governments or otherwise of international interest, and particularly on outbreaks or infestations in previously free areas;

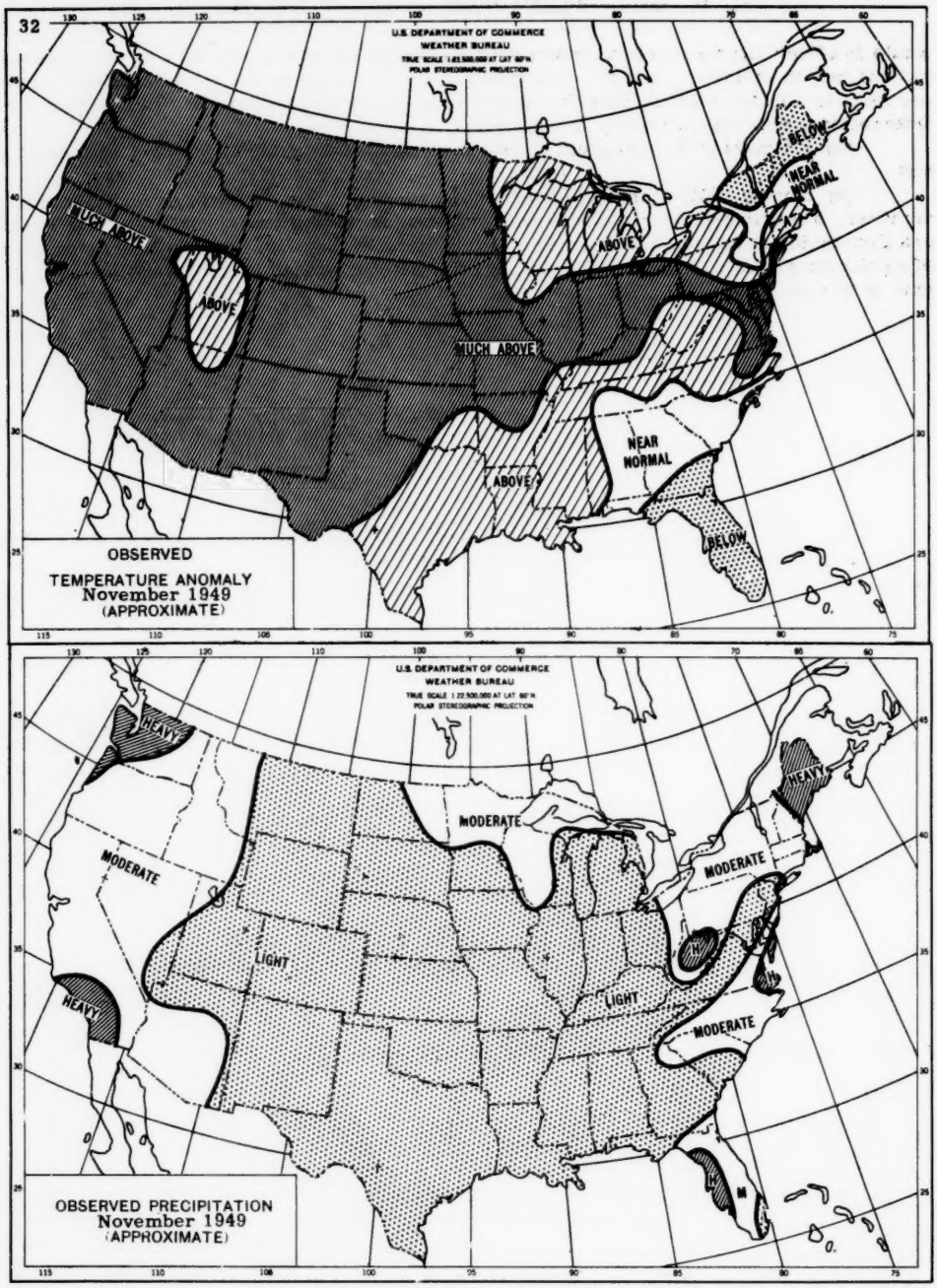
(2) FAO should facilitate action taken by governments to eradicate and control plant diseases;

(3) as a first step the Director-General should explore the possibility (a) of enlisting the aid of member countries which have national reporting services with a view to stimulating and assisting in the improvement of these services and the development of inter-relationships which

would in effect link them into an international network by making use also of any regional organizations now in existence; and (b) of stimulating and assisting in the establishment of national services in countries where they do not now exist, with the objective of making them part of an international network as rapidly as possible;

(4) a report on the progress of this investigation be made to the next regular Conference; and

(5) During 1950, immediately after the meeting in the Netherlands on phytopathological services, a meeting of specialists be held to consider the desirability of modifying the Phylloxera Convention at Berne, 1881 and the Plant Protection Convention of the International Institute of Agriculture (IIA) at Rome, 1929; and that the International Wine Office be invited to participate in this meeting.



The terms used in the accompanying maps, which define the ranges of temperature and precipitation, are numerical class limits. These are based on a statistical analysis of past records through which is determined the normal frequency of occurrence of temperatures and precipitation at various times of the year for different locations. For temperature the classes above, below, and near normal are so defined that they each normally occur one-fourth of the time; much above and much below normal, one-eighth of the time. Precipitation is depicted in terms of light, moderate, and heavy, each class normally occurring one-third of the time and thereby having equal probability of occurrence. These maps graphically represent only the general trends and give the country's weather picture at a glance. For quantitative studies, where monthly mean temperatures and actual precipitation records are needed for a given time and place, other publications of the Weather Bureau should be consulted.